FLORIDA POLYTECHNIC UNIVERSITY

Engineering, Industry, and Society Standards

The Role of Standards in Multidisciplinary Capstone Projects

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What are Standards?

- **Definition:** Standards are documented agreements containing technical specifications or criteria to be used consistently as rules, guidelines, or definitions.
- **Purpose:** Ensure safety, quality, and interoperability across products, systems, and services.
- **Key Point:** Standards govern the consistency of everything from engineering products to environmental policies.

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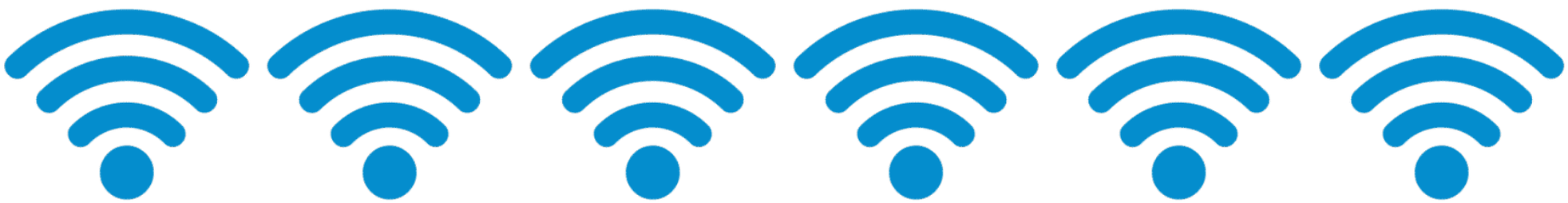
Types of Standards

- **Engineering Standards:** Technical specifications for the design, testing, and construction of products (e.g., ASME, IEEE, ISO).
- **Industry Standards:** Specific to industries like automotive, aerospace, and manufacturing (e.g., ASTM, SAE).
- **Societal Standards:** Broader standards focused on social responsibility, sustainability, and ethical practices (e.g., LEED, ISO 14001).
- **Key Point:** Standards exist at different levels—technical, operational, and ethical—and shape multidisciplinary projects.

Electrical Engineering Example

Wireless Communication Project Using IEEE 802 Standards

- **Scenario:** The students are working on a prototype for a smart home device that communicates wirelessly with other devices. It needs to be interoperable with existing Wi-Fi networks.
- **Standard Application:** The team uses the IEEE 802.11 standard to ensure the device can communicate effectively on common Wi-Fi networks. This involves aligning their design with frequency bands, data transmission protocols, and security features outlined in the IEEE standard.
- **Outcome:** By following the IEEE 802.11 standard, the prototype is compatible with home routers and other devices, ensuring that it can be marketed as a reliable, interoperable product.



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Computer Science/Cybersecurity Example

Software Development ProjectUsing ISO/IEC 27001

- **Scenario:** A student group is developing an online platform that stores sensitive user information, such as passwords and financial details. Security and data protection are critical to the success of the platform.
- **Standard Application:** The team implements the ISO/IEC 27001 information security standard to create a secure system. This includes encryption protocols for data storage, secure login procedures, and regular security audits as required by the standard.
- **Outcome:** The final product complies with industry-standard security practices, ensuring that users' data is protected from cyberattacks and breaches, which could otherwise compromise the project’s credibility and legal standing.

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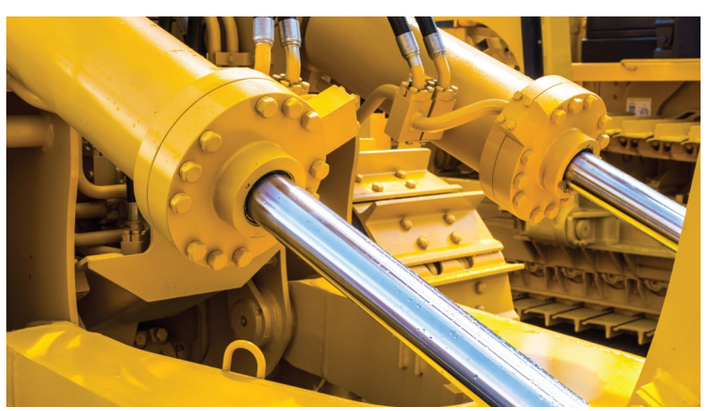
Mechanical Engineering Example

Pressurized Fluid System Design Using ASME Boiler and Pressure Vessel Code (BPVC)

- **Scenario:** A student group is designing a hydraulic system for an industrial application. The system will handle pressurized fluids, which could lead to catastrophic failure if not properly designed.
- **Standard Application:** The team uses the ASME BPVC to ensure their design can withstand the maximum internal pressure without deformation or rupture. They consult the standard for specifications on material thickness, welding methods, and pressure testing.
- **Outcome:** By adhering to ASME BPVC, the team ensures their prototype meets safety requirements and prevents pressure-induced failures, which is critical for its real-world application in industrial settings.



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Data Science/Business Analytics Example

Data Analytics Project Using ISO/IEC 25012 and GDPR Compliance

- **Scenario:** The team is developing a business intelligence platform that processes large datasets from European clients, requiring strict compliance with data protection laws.
- **Standard Application:** The group follows ISO/IEC 25012 to ensure data quality, verifying that the datasets are accurate, consistent, and complete. They also ensure compliance with GDPR by anonymizing personal data, obtaining user consent for data processing, and implementing data deletion protocols.
- **Outcome:** Their platform not only maintains high data quality but also avoids legal penalties by complying with GDPR, making it suitable for commercial use in the European market.

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Environmental Engineering Example

Air Pollution Control Device Using ISO 14001 and EPA Air Quality Standards

- **Scenario:** The student group is developing an air filtration system for an urban setting where air pollution is a major concern. The system needs to meet environmental regulations for particulate matter emissions.
- **Standard Application:** The team incorporates ISO 14001 for environmental management, ensuring that the design minimizes its environmental impact. They also adhere to EPA air quality standards, using guidelines for allowable emissions levels to calibrate the filtration system's performance.
- **Outcome:** The device successfully filters out harmful particulates and complies with EPA standards, making it a viable solution for reducing air pollution in cities while also meeting sustainability goals set by ISO 14001.

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Civil Engineering Example

Sustainable Urban Development Project Using LEED Certification

- **Scenario:** The team is tasked with designing a new office building that is energy-efficient and environmentally friendly. Achieving LEED certification is a primary goal for the project.
- **Standard Application:** The team consults LEED guidelines to optimize their design. They choose sustainable materials, implement energy-saving technologies like solar panels, and design efficient water management systems to minimize environmental impact.
- **Outcome:** The project achieves LEED Silver certification by meeting sustainability goals in energy efficiency, material selection, and waste reduction. This not only enhances the building's marketability but also demonstrates a commitment to environmental responsibility.

Finding and Using Standards

Why Finding the Right Standards Matter

- Every engineering project must align with industry, engineering, or societal standards to ensure it meets legal, safety, and operational requirements.
- Adhering to standards builds credibility and trust, ensuring that prototypes are functional, interoperable, and market-ready

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Finding and Using Standards

Where to Find Standards

- **ANSI** (American National Standards Institute): Coordinates U.S. standards and represents the U.S. in international standardization. It's a good starting point for finding U.S. national standards.
- **ISO** (International Organization for Standardization): Provides a wide range of international standards for various industries, from quality management (ISO 9001) to environmental management (ISO 14001).
- **IEEE** (Institute of Electrical and Electronics Engineers): A leading source for standards in electrical and electronic engineering, including network protocols and system design.
- **ASME** (American Society of Mechanical Engineers): Offers standards for mechanical engineering, including the widely used Boiler and Pressure Vessel Code (BPVC).
- **LEED** (Leadership in Energy and Environmental Design): Green building certification program used internationally for environmentally responsible and energy-efficient construction.

Finding and Using Standards

How to Access Standards

- **University Access:** Many universities provide free access to standards through library databases.
- **Professional Memberships:** Joining organizations like ASME, IEEE, or LEED often provides students and professionals with access to standards.
- **Public Access:** Some standards (especially older versions) may be freely available online, while others may need to be purchased or accessed through a library.

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Discussion and Application

Smart Water Fountain Design(1)

- A team is working on the design of a new smart water fountain. The fountain will include features such as water filtration, motion sensors for hands-free operation, and data monitoring to track water usage and maintenance needs.
- The team must identify and apply relevant standards to ensure the safety, functionality, and environmental impact of the product.

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Discussion and Application

Smart Water Fountain Design (2)

- Engineering Standards:
  - **ISO 24510:** Drinking water standards for quality and safety.
  - **IEEE 802:** Wireless standards for the data monitoring system.
- Industry Standards:
  - Materials for the fountain must meet durability and safety standards, potentially referencing **ASTM** (American Society for Testing and Materials) for construction materials.
- Societal Standards:
  - Environmental impact through **ISO 14001** for sustainability, given the energy and water use.

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Discussion and Application

Smart Water Fountain Design (3)

- How do these standards shape the design?
  - The fountain's design must ensure filtered water meets health and safety standards.
  - The wireless system must be compatible with existing data networks (IEEE 802), and materials used must be durable and safe for long-term use in public areas.

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Discussion and Application

Smart Water Fountain Design (4)

- Break Into Groups of 3-4
- Each group will identify specific challenges and considerations in applying their assigned standards to the smart fountain in one of the areas below:
  - Water quality and filtration standards (ISO 24510).
  - Wireless communication standards (IEEE 802).
  - Environmental sustainability (ISO 14001).
- After 10 or so minutes, present how standards impact your portion of the project and what design adjustments are needed to comply.

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Discussion and Application

Smart Water Fountain Design (5)

- Challenge(s) in Applying Standards:
  - The water filtration system needs to meet both ISO 24510 for drinking water and be energy-efficient, which could create a trade-off between performance and sustainability (ISO 14001).
- Overcoming Challenge(s):
  - Designing the filtration system to be both compliant and energy-efficient may require innovative materials or filtration methods.

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Discussion and Application

Smart Water Fountain Design (6)

- Real-World Impact of Standards:
  - How would failing to meet these standards affect the product's success?
    - Example: If the fountain doesn't meet water safety standards, it could lead to public health concerns, legal liabilities, and product recalls.
- What are the societal benefits of ensuring safe, sustainable, and well-designed products.

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